

REMARKS/ARGUMENTS

Claim Amendments

By the claim amendments presented herein, independent heat recovery process claim 1 would be rewritten to expressly indicate that, in the first process step, it is the effluent stream “from a catalyst regenerator” which is passed to a heat exchanger. Support for this amendment to claim 1 can be found, *e.g.*, in the preamble of this claim.

Also by the amendments presented herein, claims 1, 21, and 26 would be rewritten to characterize the boiler feed water fed from the steam drum to the steam generator as being “liquid, preheated” boiler feed water. Support for these claim amendments can be found, for example, in paragraph [0114] of the specification, where conduit 218 of Figure 2 is described as taking liquid preheated boiler feed water from the steam drum to the steam generator.

Also by the claim amendments presented, the claim 16 element concerning high pressure steam being taken from the steam drum would be incorporated into claim 1. Claim 16 would accordingly be cancelled.

Also by the claim amendments presented, independent apparatus claim 21 would be rewritten to incorporate therein the element of original claim 22 regarding conduit means for passing high pressure steam from the steam drum element of the claimed apparatus. Claim 22 would accordingly be cancelled.

Also by the claim amendments presented, claims 38 and 39 would be cancelled inasmuch as the elements of these cancelled claims are already found within original claim 26 from which these two claims directly or indirectly depend.

Upon entry of the claim amendments presented herein, claims 1-15, 17-21, 24, 26-37, and 40-46 would remain pending in the application. No new matter is believed to be included, nor are any new issues believed to be raised, by these claim amendments. Also, no additional claims fees would be believed to be due as a consequence of entering these amendments.

Invention Synopsis

By way of review the present invention in one embodiment is directed to a process for recovering heat from a high temperature effluent stream from a catalyst regenerator. In this embodiment, the effluent stream of a catalyst regenerator can be passed first through a first heat exchanger associated with a steam generator fed with boiler feed water to produce high pressure steam and to partially cool the effluent stream. The partially cooled effluent stream can then be passed through a second heat exchanger associated with a high pressure boiler feed water preheater to provide preheated boiler feed water and to further cool the effluent stream. The high pressure steam from the first heat exchanger and the preheated boiler feed water from the second heat exchanger can both be passed to a steam drum for mixing. High pressure steam can be taken from the steam drum for other process uses. Preheated boiler feed water can also be taken from the steam drum and can be passed to the steam generator associated with the first heat exchanger. In preferred embodiments, catalyst fines can be removed from the regenerator effluent stream (i) before the effluent stream enters the two heat exchangers, (ii) after the effluent stream has passed through the two heat exchangers, or (iii) when it is in between the two heat exchangers.

In another embodiment, the present invention is directed to an apparatus setup suitable for carrying out the heat recovery process herein. In still another embodiment, the invention relates to a process for catalytic conversion using a molecular sieve catalyst, wherein the catalyst used is regenerated in a regenerator, and the regenerator effluent is treated in the manner described above to recover useful heat energy therefrom.

Formal Matters

Claim 16 has been objected to under 37 C.F.R. § 1.75(c), as being in improper dependent form inasmuch as it depends from a cancelled claim. Cancellation of claim 16, as set forth in the new Listing of Claims presented herein, would obviate the objection to this claim.

Art Rejections

Rejection Under 35 U.S.C. § 102 Over Jörgensen

Claims 1, 8-11, 15-17, 20-31, 38-40, and 44 have been rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 4,509,326 to Jörgensen (“Jörgensen”). The Examiner maintains his contention that Jörgensen, with particular reference to its Figures 2-5, discloses each and every element of the rejected claims. Such a rejection is again respectfully traversed, as it would apply to the claims as they would be amended herein.

Jörgensen is directed to a process for extracting energy and removing solid particles from a stream of hot, dust-laden gas. In the Jörgensen process, energy is extracted from a hot dust-laden gas stream by a process in which the hot gas stream, before being cooled or purified, is used to generate steam in a boiler arrangement involving a heater (7), a reservoir (8), an evaporator (9), and a superheater (10). Then further in the Jörgensen process, the solid particles are removed from the cooled gas stream which is then supplied to a turbine.

It is respectfully submitted that the Jörgensen heat extraction arrangement represents a different configuration of heat exchange elements which remove heat from an effluent gas stream in a different manner and order from that of Applicants’ process and apparatus claims. Such a Jörgensen arrangement, in fact, produces a different configuration of preheated water and superheated stream streams from that used in and resulting from Applicants’ claimed invention.

In the Jörgensen process, the particle-containing hot effluent gas first encounters a superheater element (10), which the Examiner erroneously characterizes as a heat exchanger “associated with a steam generator (9)”. The Jörgensen element (10) is, in fact, a superheater, which is clearly not associated with the Jörgensen evaporator (9), in the sense that superheater (10) supplies no thermal energy to the evaporator (9). If the Examiner regards the Jörgensen superheater (10) as corresponding to Applicants’ first heat exchanger, then this Jörgensen element (10) does not impart heat to liquid preheated boiler feed water therein and does not send high pressure steam to a steam drum (or to any Jörgensen element which arguably corresponds to a steam drum). Both of these features are required of Applicants’ claimed first heat exchanger, and yet neither is found in Jörgensen.

In the Jörgensen process, after leaving the superheater (10), the Jörgensen hot gas is next passed to an evaporator (9). In this evaporator (9), preheated feed water is converted to steam, which is passed to the Jörgensen reservoir (8). If the Examiner regards the Jörgensen evaporator (9) and reservoir (8) as corresponding to Applicants' first heat exchanger and steam drum, respectively, then there are also some additional significant differences between these elements of the Jörgensen reference and those corresponding elements of Applicants' invention. Clearly, the Jörgensen evaporator (9) does not produce high pressure steam, as is required of the first heat exchanger in Applicants' claimed arrangement, because the effluent gas in Jörgensen has already had substantial heat extracted by the Jörgensen superheater (10), which produces high pressure steam. Further, the Jörgensen reservoir (8) cannot correspond to Applicants' steam drum, as the Examiner contends, because the only gaseous stream leaving the Jörgensen reservoir (8) is "water vapor" being fed to the superheater (10). This "water vapor" is simply not high pressure steam, as is required in Applicants' claims to be produced by Applicants' steam drum.

In short, the Jörgensen reference does not disclose each and every element of Applicants' claims, as they would be amended herein, nor does it disclose Applicant's specified relationship among the several types of heat extraction and the heated or cooled stream-producing elements of Applicants' claims. It is therefore submitted that continued rejection under 35 U.S.C. § 102(b) of Applicants' claims 1, 8-11, 15-17, 20-31, 38-40, and 44, if amended as proposed, would be improper.

Rejection Under 35 U.S.C. § 103 Over Woebcke *et al.*

Claims 2, 3, 32, and 33 have been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Patent No. 3,910,768 to Woebcke *et al.* ("Woebcke"). The Examiner continues to maintain that Woebcke discloses all of the elements of the rejected claims, except for the final temperature of the cooled effluent gas, which the Examiner alleges would have been obvious from the Woebcke quench step. Such a rejection is again respectfully traversed, as it would apply to the claims as they would be amended herein.

By way of review, Woebcke is directed to a high-pressure furnace for thermally cracking hydrocarbons to produce olefins. Flame burners are used to produce combustion gases to

circulate through radiant and convection sections of a furnace under pressure to crack hydrocarbons. Heat from flue gas streams from the furnace sections serves to produce high-pressure steam, provide coolant to quench cracked gas, to preheat the hydrocarbon-steam feed, and to aid in driving a turbine-compressor assembly.

It is again respectfully submitted that Woebcke fails to teach or suggest several essential elements of Applicants' claimed processes and claimed apparatus set up. In the first place, as noted in Applicants' previous response, the Woebcke process relates to thermal, not catalytic, cracking of hydrocarbons. There is thus no disclosure or suggestion whatever in Woebcke of heat extraction out of flue gas from a catalyst regenerator as in Applicants' invention. The Examiner has urged that this feature of Applicants' invention cannot be given any weight in distinguishing Woebcke because it is only mentioned in the preamble of the rejected claims. By the amendments presented herein, Applicants would insert the requirement that catalyst regenerator flue gas be used into the main body of the rejected claims. It is once again submitted that this feature alone is sufficient to obviously distinguish Woebcke.

In the Final Rejection, the Examiner further urges that, even if Woebcke does not relate to treatment of catalyst regenerator effluent, there is no "manipulative difference" between the steps and elements of the Woebcke heat recovery arrangement and those set forth in Applicants' claims. Applicants respectfully submit that this is not the case either. The Examiner notes that in Woebcke a high temperature effluent stream (122) from one section of the Woebcke furnace is sent to heat exchanger (111). The Examiner then contends that this heat exchanger (111) is "associated" with a steam generator (106). The Woebcke heat exchanger (111) is, in fact, not "associated" with steam generator (106). Rather, the Woebcke steam generator (106) is a separate heat exchanger that extracts heat from a completely different hot effluent stream associated with another section of the Woebcke furnace. Furthermore, the steam generated in Woebcke unit (106) and held in steam reservoir (108) is not made from liquid boiler feed water that has been preheated by heat exchange with the hot effluent gas stream, as in Applicants' claimed invention.

Further, with respect to the Woebcke setup, although the heat from the initial cooling of the original Woebcke hot effluent stream does provide steam in heat exchanger (111), that steam

is mixed with hydrocarbon feed for cracking and is fed back into the other section of the Woebecke cracking furnace and not to a steam drum, as in Applicants' claimed invention. Finally, after initial cooling in heat exchanger (111), the original hot effluent stream (122) in Woebecke is passed on to heat exchanger (124), wherein heat is transferred from the effluent gas stream and not to liquid boiler feed water, as in Applicants' claimed invention, but rather to an oil or Dowtherm heat transfer medium.

In short, the Woebecke patent relates to a completely different kind of non-catalytic hydrocarbon conversion process from that specified in Applicants' claims, and, in any event, does not teach or suggest the same, or even a similar, type and configuration of heat recovery from catalyst regenerator flue gas as is described in Applicants' claims. Accordingly, it is submitted that the Woebecke reference, for a number of different reasons, does not render Applicants' claims, as they would be amended herein, obvious under 35 U.S.C. § 103.

Rejections Under 35 U.S.C. § 103 Over Jörgensen or Jörgensen In View of Vaughn

Claims 4, 12-14, 26, 34, 45, and 46 have been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Jörgensen alone, or in view of U.S. Patent Application Publication No. 2002/0016522 to Vaughn ("Vaughn"). The Examiner continues to maintain that such features of these rejected claims as final effluent gas temperature, catalyst fines removal, and use of molecular sieve catalysts are all obvious modifications of Jörgensen or are suggested by Jörgensen and Vaughn. Such a rejection is again respectfully traversed, as it would apply to the claims as they would be amended herein.

The teachings of the Jörgensen reference have been discussed above. Vaughn has been cited merely for its teaching of the use of molecular sieve catalysts in fluid catalytic cracking of hydrocarbons.

Without reaching the issue of whether it might obviously be possible to carry out the Jörgensen process using the effluent gas final temperature, the catalyst fines removal, or the catalyst type elements of the rejected claims, it is nevertheless submitted that the heat recovery configuration differences between Jörgensen and Applicants' claimed invention, as such

differences were highlighted above, are not merely obvious variations of the Jörgensen process and apparatus. The skilled artisan simply would not be lead either by background knowledge or skill or by the Vaughn reference to modify the Jörgensen setup in order to realize the particular arrangement and relationship of elements as described by Applicants' claims, as they would be amended herein. Accordingly, continued rejection of Applicants' amended claims 4, 12-14, 26, 34, 45, and 46 as being obvious over Jörgensen, as the sole or primary reference, would thus be improper.

Rejections Under 35 U.S.C. § 103 Over Haddad or Haddad In View of Vaughn

Claims 5-7, 18, 19, 35-37, and 41-43 have been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Patent No. 5043,517 to Haddad ("Haddad"), alone or in view of Vaughn. The Examiner continues to maintain that Haddad discloses the basic heat exchanger configuration of Applicants' claimed invention and that such features of the rejected claims as use of a steam drum, heat exchanger pressures, and types of catalytic conversion processes being run are all suggested by Haddad alone or in combination with Vaughn. Such a rejection is again respectfully traversed, as it would apply to the claims as they would be amended herein.

Haddad discloses a reactor and catalyst regenerator setup for conversion of light olefins to heavier hydrocarbons in a fluidized catalyst bed. Figure 1 of Haddad discloses use of two heat exchangers (33a and 33b) to cool the hydrocarbon effluent (10) from the reactor and, at the same time, to provide superheated high pressure steam from water fed to the first of such heat exchangers (33a), which are then fed through a coil (31) in the fluidized bed of catalyst being regenerated, and which are finally fed through the second heat exchanger (33b).

In the first place, Applicants would reiterate that Haddad discloses no arrangement at all for the recovery of heat from the effluent of a catalyst regenerator, which is the primary purpose of the presently claimed process and apparatus. In Haddad Figure 1, the catalyst regenerator effluent is shown as stream (29), which clearly shows no heat recovery from that stream (29) by any means. Thus, one of ordinary skill in the art looking to address the problem of heat recovery from catalyst regenerator effluent would not be motivated to turn to Haddad for any such

guidance in the first place. In the absence of the Examiner providing a scientific basis, Applicants respectfully submit that such a suggestion to do so must be assumed to originate in hindsight, which is an improper basis for rejection

Secondly, assuming *arguendo* that one of ordinary skill in the art would be motivated to substitute heat recovery from, and steam generation by, the hydrocarbon product stream in Haddad for the catalyst regenerator effluent treatment of Applicants' invention, Applicants' claimed process and apparatus still do not result. The boiler feed water in Haddad is heated in heat exchanger (33a) and is then fed through the heating coil (31) within the bed of catalyst in the regenerator. This converts the boiler feed water to a mixed steam-water stream (32), which is fed to steam generator (33b). Applicants' claimed invention, on the other hand, requires the stream being fed to the steam generator for steam generation therefrom to be liquid preheated water. Haddad thus *teaches away* from this aspect of Applicants' claims.

Additionally, Applicants' claimed invention further involves contact of preheated boiler feed water and high pressure steam in a steam drum, from which liquid water and high pressure steam are both withdrawn. Clearly, Haddad shows no such steam drum element. The Examiner contends, however, that the addition of such a steam drum element would be obvious, because Haddad also produces high pressure steam. It is respectfully submitted that high pressure steam is realized in Haddad because of the extra heat provided in the heating coil (31) placed within the catalyst regenerator catalyst bed. Applicants' claimed invention does not have such an element and uses the steam drum as a non-obvious means for effectively producing both the desired high pressure steam and the requisite preheated boiler feed water.

In short, Applicants respectfully submit that the Haddad patent is inappropriately applied in rejection of Applicants' claims 5-7, 18, 19, 35-37, and 41-43. And, in any event, Haddad fails to disclose or suggest all of the elements of Applicants' process and apparatus, as they would be claimed herein. Continued rejection of claims 5-7, 18, 19, 35-37, and 41-43 under 35 U.S.C. § 103, using Haddad as the sole or primary reference, would therefore be improper.

CONCLUSIONS

Applicants have made an earnest effort to place their application in proper form and to distinguish their claimed invention from the applied prior art. WHEREFORE, reconsideration of this application, entry of the claim amendments presented, withdrawal of the claim objection and claim rejections under 35 U.S.C. §§ 102 and 103, and allowance of claims 1-15, 17-21, 24, 26-37, and 40-46 are all respectfully requested. Alternatively, entry of the amendments presented herein in order to place the claims in better form for appeal is respectfully requested.

It is also respectfully requested that the Examiner expeditiously notify Applicants' undersigned attorney as to the disposition of the amendments and arguments presented herein in accordance with M.P.E.P. § 714.13.

If there are any questions regarding this response or the application in general, a telephone call to the undersigned would be appreciated, since this should expedite the prosecution of the application for all concerned.

Respectfully submitted,

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